SUBJECT INDEX

A

Acoustic wave
  and boundary-layer receptivity, 147–48
Acoustics
  and turbulent wall flows, 14
Aerosol clouds
  dynamics of, 391, 413
Airfoil(s)
  energy-efficient, 236
  and turbulent boundary-layer flow, 229, 231
Airplanes
  and transatmospheric flight, 390–91
Algebraic second-moment modeling
  in turbulent flows, 114
Algorithms
  and computational fluid dynamics, 348–50, 352–53, 356–57, 360–69, 372
    free Lagrangian, 350, 367–69
    near-neighbors, 358–61
    numerical, 345, 347
Arcade effects
  and microvascular networks, 196
Arterial wave propagation, 173–75
Artificial-intelligence techniques
  in computational fluid dynamics, 380
Atherogenesis, 177–78, 180
Atherosclerosis, 199
Atherosclerotic plaque, 177
Atmospheric boundary layer (ABL)
  and ocean boundary layer, 420–23
Attachment line
  in swept-wing flows, 271–74
Attachment-line stability
  in three-dimensional boundary-layer flows, 271–75

B

Backflow
  in turbulent boundary-layer separation, 209–31 passim
Backward-facing step flows
  in turbulent boundary layers, 220–24
Bends
  and blood flow, 177–80, 199
BGK equation
  and rarified gas dynamics, 396
Bifurcation
  in blood-flow studies, 178
Binary reactions
  and nonequilibrium aerodynamics, 41–42
Binary scaling
  and nonequilibrium aerodynamics, 42–43, 45, 49–50
Biofluid mechanics, 167–99
  and finite-element methods, 181–84
  and lubrication theory, 184–87
Biological systems
  and phoretic transport processes, 94–96
Blood
  rheological properties of, 168–72
Blood flow
  computational methods for, 194–95
  at high Reynolds number, 172–80
  into and out of the heart, 180
  at low Reynolds number, 180–90
  macrorheology of, 170–72
  microrheology of, 169–70
  in vascular networks, 190–99
Bluff bodies
  and turbulent boundary-layer separation, 220–27
Blunt-body flows
  binary-scaling similitude for, 42
  and free-stream dissociation, 43
  and nonequilibrium flows, 52–54
  and shock-density ratio effect, 44
Boltzmann equation
  in kinetic theory of gas flows, 393–94
  and rarified gas dynamics, 396–99
Boundary layer(s)
  adjustment mechanisms in, 159–63
  ocean surface, 420–30
  separation in flow, 205
  swept-wing flows, 236–58
  three-dimensional
    complex geometries with, 271
    and a rotating disk, 258–64
    stability of, 235–76
  turbulent
    and dense-gas dispersion, 324
Boundary-layer receptivity
  to long-wave free-stream disturbances, 137–64
Boundary-layer separation
  turbulent, 205–32
    from bluff bodies and reattachment, 220–27
    and dynamic stall, 229–30
    self-induced unsteadiness, 230–31
    steady free-stream, 207–13
    and surface curvature, 216–19, 231
    and surface-pressure fluctuations, 213–16, 231
    unsteady, 227–31
Boussinesq approximation
  and turbulent diffusion flames, 115–16
Branches
  and blood flow, 177–80, 199
Bubble clouds
  and surface waves, 425–27
Bubble injection
  and wall flows, 6
Bubbles
  transport of, 93
Bulbar conjunctiva, 196
  microvascular in, 198
Buoyancy flux
  and ocean turbulence, 441–44
Bursting
  in turbulent boundary layers, 207–8
  in wall flows, 3–6, 9, 11–12, 14–15

C

C-SALT, 433–36, 438
Calculation methods
  for turbulent diffusion flames, 101–2
Capillary-driven flow, 66
"Cat's eye"
  in swept-wing flows, 239
Cauchy stress
  and viscoelastic fluids, 21–22
Cells
  motion of vesicles within, 94–95
  spatial dimensions divided into

in computational fluid dynamics, 351–54, 363, 75
Cellular-automata computer
and computational fluid dynamics, 350, 353, 374–75
Cellular-automata models
in computational fluid dynamics, 350, 352–58, 368
Centrifugal instability
in a three-dimensional boundary layer, 237
Cerebral-spinal fluid, 168
Chapman-Enskog theory
in molecular interactions, 403
Charge-coupled devices (CCDs), 381
Chemical reactions
and turbulent wall flows, 7
Chemiphoretic effect, 71, 79–80
"Chunking,"
of fluids, 355–56
Circulatory system
flow patterns in, 172–73
Coherent structures
in turbulent free shear flows, 285–311
Colloid transport
by interfacial forces, 61–97
experimental studies, 87–93
Combustion
in diffusion flames, 101
and gradient models, 111–12
Combustion systems
engineering calculations in, 114
and turbulent diffusion flames, 101
Compressibility
in wall flows, 5
Compressor blades
and dynamic stall, 229
Computational fluid dynamics (CFD), 345–82
adaptive and unstructured gridding in, 350, 362, 364–65
and algorithms, 361–69
applications of, 376–82
artificial-intelligence techniques in, 380
current status of, 347–49
discretization in, 351–52
free Lagrangian algorithms in, 350, 367–69
and hybrid cellular-automata computer, 350, 353, 374–75
lattice-gas cellular-automata models in, 352–57, 368
and molecular dynamics, 350, 352, 357–58, 368
near-neighbors algorithms in, 358–61
parallel processing for, 350, 371–74
phenomenologies in simulations, 376–79
spectral-element methods in, 350, 362, 365–67
and supercomputer architectures, 369–71
vs. laboratory experiments, 347
Computational methods
for blood-pressure and flow, 194–95
Computer codes
and three-dimensional boundary-layer flows, 243–44, 247–48
Computer systems
satellite, 389–90
Computers
and computational fluid dynamics, 347–49, 361–62, 364–65, 369, 378–79, 382
Condensation-induced flows, 410–11, 413
Conserved scalar(s)
and turbulent diffusion flames, 126
in turbulent flows, 102–4, 112
Conserved scalar probability density function, 119–21
Contamination
leading-edge
in swept-wing flows, 272
spanwise turbulent, 272–73
in swept-wing flows, 241–42
in a three-dimensional boundary layer, 237
Convection
in computational fluid dynamics, 363
and interfacial flow, 78
in the ocean boundary layer, 425
Coriolis forces
and rotating disk flow, 261–62
Coronary flow, 180
COSAL computer code, 244
Couette flow
and discrete-velocity gas models, 398
Counterion
and interfacial polarization, 79
Crossflow instability
on a rotating disk, 258
on swept wings, 238–58, 269
in a three-dimensional boundary layer, 237
Curvature
streamline
and rotating disk flow, 261–62
surface
in three-dimensional boundary-layer flows, 244–45

D

Da Vinci, Leonardo, 180
Damköhler number
and turbulent flows, 104–5, 108, 110, 127
Delta-wing shock standoff, 54
Delta wings
nonequilibrium flows over, 56–57
Dense-gas clouds
formation of, 319–21
Dense-gas dispersion, 317–41
concentration fluctuations, 340–41
continuous releases, 322–27, 335
and hazard analysis, 317–18
influence of buildings and obstacles, 333–35, 341
influence of topography, 335–37, 341
models for, 318, 329–33
near-instant release, 327–29
physical modeling for, 337–40
physical processes in, 321–22
quantitative assessment, 318
and surface roughness and atmospheric stability, 340
Density
of seawater, 430
Density-weighted averaging
in turbulent flows, 109–10, 113–15
Detachment
in turbulent boundary layers, 206–28 passim
Diapycnal mixing
in ocean models, 444–47
Diffusiophoresis, 78–79, 94
experimental studies of, 88–91
Direct simulation Monte Carlo (DSMC) technique
and rarified gas dynamics, 396–98, 403–10, 413
Discrete-velocity model
for gas, 398–99
Dissipation rate(s)
and ocean boundary layer surface zone, 422–23

of ocean temperature variance, 432–33
in the upper ocean boundary layer, 425
Dissipation scales
and shear-generated ocean turbulence, 436–43
Dissociated free stream
and nonequilibrium aerodynamics, 43–45
Dissociation
molecular
and hypervelocity aerodynamics, 37–38, 41–42
Dissociation-decay effect
Gibson's free-stream, 45
Dissociation reactions
and nonequilibrium aerodynamics, 39–41, 48

E

Ear
fluids in, 168
Earth's rotation
and turbulence in the ocean boundary layer, 430
Eddies
Langmuir, 424–25
large
and turbulent boundary-layer flow, 209, 211–13, 219, 221
turbulent
in the ocean boundary layer, 427
Eddy
Meddy, 432, 435–36
shocklets, 5
"Eddy Break-Up" (EBU) model
and fast-chemistry reaction rate, 108–9
Electrohydrodynamic (EHD) body force
and turbulent wall flows, 2, 6–7
Electrokinetic theory
and electrophoretic mobility of particles, 87–88
Electron-beam fluorescence studies
on gas flow, 400–1, 406, 408
Electroosmosis
and colloid transport, 66–68
Electrophoresis, 62–64, 76, 78–79
Electrophoretic mobility
of colloid particles, 87–88
of a particle, 80–81
of red-blood-cell "ghosts," 92–93
Electrophoretic motion
near a fixed boundary, 84–87
Emmons spots
and turbulent wall flows, 10
Energy estimates
and viscoelastic fluids, 26
Enthalpy
free-stream, 43–45
stagnation
and nonequilibrium aerodynamics, 47, 49–50
Entrainment rates
in the upper ocean boundary layer, 425
Entrainment velocity
in dense-gas dispersion modeling, 331–32
Euler equations
and arterial wave propagation, 173
and rarefied gas dynamics, 395
Eulerian algorithms
in computational fluid dynamics, 363–64, 367
Eulerian grids
in computational fluid dynamics, 368
Evaporation-induced flows, 410–11, 413
Expansion tube
and nonequilibrium aerodynamics, 45, 49–50
Experimental facilities
for nonequilibrium aerodynamics, 45–50
Eye
fluids in, 168

F

Fahraeus effect
in blood flow, 171–72
Fahraeus-Lindqvist effect, 188
in small tubes, 171–72
Falkner-Skan-Cooke yawed wedges
in three-dimensional boundary-layer flows, 243
Fast-chemistry reaction rate
and turbulent diffusion flames, 107–9
Fast chemistry structure
and turbulent diffusion flames, 104–7
Favre averaging
in turbulent flows, 114–15
Fence flows
in turbulent boundary layers, 224–27
Finite-EleMent Flux-Corrected Transport (FEM-FCT)
for computational fluid dynamics, 362
Flame structure
and turbulent diffusion flames, 127–31
Flamelet theories, 103, 130
Flames
turbulent diffusion, 101–31
Flight
transatmospheric, 390–91
Floquet theory
and three-dimensional boundary-layer flows, 254–55
Flow(s)
of blood in bends and branches, 177–80, 199
in collapsible tubes, 175–77
coronary, 180
multifile
of blood cells, 188–90
swept-wing, 236–58
Flow-field studies
and Knudsen layers, 407–8
Flow fields
instrumentation techniques for, 400–1
Flow visualization
and fluid-dynamic experimentation, 381
Flux laws
applied to the ocean, 434–36
Flux-Corrected Transport (FCT)
in computational fluid dynamics, 362
Flux-Corrected Transport algorithms
in computational fluid dynamics, 373–74
Forward-facing step flows
in turbulent boundary layers, 224–27
Fourier transform
and boundary-layer flows, 162
Free-jet flows
and molecular beams, 401–3
Free-molecular pressure probe, 400
Free-piston driver
and nonequilibrium aerodynamics, 48–50
Free-stream disturbances
boundary-layer receptivity to long-wave, 137–64
Froude number
in dense-gas dispersion, 334

G

Gas
contamination in a reflected shock tunnel, 46–48
see also Dense-gas dispersion

Gaster's criterion
and attachment line of swept wings, 274
Gaussian dispersion models
and dense-gas dispersion, 330
Geometric parameters
and turbulent wall flows, 7–9, 11–13
Gibbs dividing surface, 74
Gibbs phenomenon oscillations
in computational fluid dynamics, 363
Görtler instability
and rotating cone flow, 269
Görtler vortex instability
in swept-wing flows, 237, 242, 245
Görtler vortex structure
in swept-wing flows, 239
Görtler vortices
in swept-wing flows, 247
and T-S waves, 249
Gouy-Chapman theory
of planar double layers, 70
Gradient transport modeling
and turbulent flows, 111–14
Graphical and Array Processing System (GAPS)
and computational fluid dynamics, 371–73
Gravity-driven transport
of bubbles, 93
Gridding
in computational fluid dynamics, 350, 362, 364–65

H

Heart valves
artificial, 180
Heat release
in turbulent diffusion flames, 114–17
Heat transfer
and formation of dense-gas clouds, 319–20
"Heaviside function," 292
Heaviside step function
in turbulent flow, 107
Helicopter blades
and dynamic stall, 229
Helium
as driver gas in shock tunnels, 48
Hemodynamic effects
and vascular geometry, 191–94
Hemolysis
of blood, 180
Hicks-Yen-Nordsieck (HYN) method
and rarefied gas dynamics, 396–97
Hybrid laminar flow control (HLFC), 163
Hydrogen
as driver gas in shock tunnels, 48
Hypervelocity aerodynamics
with chemical nonequilibrium, 37–58

I

Incipient detachment (ID)
in turbulent boundary layers, 206–7, 209
Interfacial forces
colloid transport by, 61–97
experimental studies, 87–93
Intermittent transitory detachment (ITD)
in turbulent boundary layers, 206–8, 218
International Symposia on Rarefied Gas Dynamics, 388
"Ion wind,"
in EHD turbulence control, 6–7
Isotope separation techniques
gas-dynamic, 391

J

Jeffreys models
and viscoelastic fluids, 32–33

K

K-BKZ fluids
motions of, 24, 26–28
kεg model of turbulence, 109
Kinetic theory of gas flows, 393–94
Knudsen layer(s)
and flow-field studies, 407–8
Knudsen number
and rarefied gas dynamics, 394–96, 398
Kolmogoroff length scale
and turbulent flows, 120, 128
Kolmogoroff scale, 126–27
Korotkoff sounds, 175, 177

L

Lagrangian algorithms
in computational fluid dynamics, 350, 363–64, 367–69
Laminar flow
breakdown of a bounded, 235–36
Langmuir circulation(s)
and ocean boundary layer, 423–25, 427–29
Laplace transform
and the Rayleigh problem in viscoelastic fluids, 29
Laplace's equation
and interfaces, 83
and phoretic transport of rigid particles, 75
Large-Eddy Breakup Device (LEBU), 14
Large-Eddy Simulations (LES)
in computational fluid dynamics, 348
Laser-Doppler velocimetry (LDV) techniques, 381
Laser-induced fluorescence
and gas flow study, 401, 410
Lattice-gas cellular-automata models
in computational fluid dynamics, 352–57, 368
Leading-edge stability
in a three-dimensional boundary layer, 237
Lewis number
in flames, 104
Lighthill-Freeman ideal dissociating gas, 41
Liquefied natural gas (LNG), 319
discharge of, 322–23
Lubrication theory
and biofluid mechanics, 184–87
Ludwieg-Tillman skin-friction equation
in turbulent boundary layers, 207
Lungs
airflow in, 167, 177
Lymph system
fluid flow in, 168

M

Mach number
in compressible wall flows, 5
independence principle, 42–43
Magnetohydrodynamic (MHD) body force
and turbulent wall flows, 2, 6
Marangoni effects, 66
MARIA computer code, 244, 251
Mathematical analysis
of viscoelastic fluids, 21–23
classification of type, 23–25
global existence and asymptotic decay, 27–28
local existence of solution for initial-value problems, 23, 25–27

propagation and development of singularities, 28–31
Maxwell models
and viscoelastic fluids, 32–33
Mean flow
and coherent structures, 297–98
modifications of, 306
Reynolds, 301
Mean-flow spreading rate, 288–93, 302
Meddy, 432
changes in T (temperature) and S (salinity) properties of, 435
fluxes, 436
Melt fracture
in fluid flow, 24
Memory functions
in viscoelastic fluids, 24, 26–27
Mesentery
network for, 198
Mie scattering, 123–24
and turbulent diffusion flames, 116
Molecular beams
gas dynamic, 401–3
Molecular dynamics
and computational fluid dynamics, 350, 352, 357–58, 368
Monotonic Lagrangian Grid (MLG)
in computational fluid dynamics, 359–61, 368–69
Monte Carlo methods
in turbulent flows, 110–11
in turbulent transport modeling, 119
see also Direct simulation Monte Carlo (DSMC) technique
Mott-Smith assumption
in molecular interactions, 396
Mott-Smith model
of molecular interactions, 404–7
Myocardial capillary network, 198

N

Navier-Stokes equation(s)
and blood-flow problems, 181
and boundary-layer flows, 143
in computational fluid dynamics, 346, 348, 355, 368
with Dirichlet boundary conditions, 28, 31
and fluids with complex microstructure, 21–22
and Newtonian fluids, 23
and rarefied gas dynamics, 395, 399, 405, 408, 410, 412–13
and scalar dissipation, 122
and swept-wing flows, 256–57
and viscoelastic fluids, 31–32
Navier-Stokes simulation(s)
and attachment-line instability, 274
and rotating disk flow, 264
and three-dimensional flows, 275
Navier-Stokes solutions
and swept-wing flows, 249
Newtonian fluids
governed by Navier-Stokes equations, 23
Nitric oxide
and nonequilibrium aerodynamics, 40
Nitrogen
dissociation of, 37, 39–40
Nonequilibrium aerodynamics, 37–58
binary reactions, 41–42
center of pressure, 55–57
constant-temperature models, 50–54
and curved shocks, 57–58
dissociated free stream, 43–45
and expansion tube, 49–50
experimental facilities, 45–50
and free-piston driver, 48–50
Mach-number independence principle and binary scaling, 42–43, 45, 49–50
and nonreflected shock tunnel, 49–50
and reflected shock tunnel, 46–48, 50
Numerical models
of the upper ocean, 429

O

Ocean boundary layer
stress-driven, 422
Ocean models
diapycnal mixing in, 444–47
Ocean surface layer (OSL), 420–30
Ocean turbulence, 419–48
double-diffusive processes, 430–36
mixing in the stratified interior, 430–44
shear-generated, 436–44
Onsager's reciprocal theorem, 71
Orr-Sommerfeld equation
and boundary-layer flows, 139, 141–43, 145–46, 157
and rotating disk flow, 264
Osmophoresis, 96
Osmosis
and flow by gradients of charged solutes, 71
and flow by gradients of neutral solutes, 68–71, 74
Oxygen
dissociation of, 37, 39–40

P

Particles
bounded systems of, 82–87
phoretic transport of rigid, 75–82
phoretic transport of solid, 93–97
Peclet number
and dense-gas dispersion, 338
Phoretic motions
and sedimentation, 96–97
Phoretic transport
and bounded systems of particles, 82–87
of colloidal particles, 63–65
of rigid particles, 75–82
of solid particles, 93–97
Piecewise Parabolic Method (PPM)
in computational fluid dynamics, 362
Poiseuille flow, 287–88
and arterial wave propagation, 174
Poiseuille's equation, 191
Poisson equation
in turbulent boundary-layer separation, 213
Polarization
interfacial, 76, 78–80
Polymers
and wall flows, 6
Pressure gradient(s)
in blood vessels, 191
on swept wings, 238
in turbulent boundary-layer separation, 209, 214, 216–18, 223, 228
and turbulent diffusion flames, 102, 116
and wall turbulence, 4–5, 11, 15–16
Probability density function (pdf)
conserved scalar
and turbulent mixing, 119–21

and fast-chemistry species, 105
in free turbulent flows, 102–3
in turbulent diffusion flames, 109–10
in turbulent flows, 113
in turbulent transport modeling, 118
Pulmonary microvasculature, 198

R

Raman scattering, 124, 130–31
Rarefied gas dynamics, 387–413
available literature, 392–93
computational, 396–99, 413
assessing, 403–8, 412
radiating, reacting, nonequilibrium, 408–10
experimental, 399–403
and shock-wave structure, 391
and surface interactions at medium energies, 411–12
theoretical, 393–96, 413
Rayleigh equation
and coherent structures, 296
in shear flows, 294
Rayleigh flow
and discrete-velocity gas models, 398
Rayleigh problem
in mathematical analysis of viscoelastic fluids, 28–29
Rayleigh scattering, 122–24, 130
Reactive Flow Model (RFM)
in computational fluid dynamics, 373
Real-time profiles (RTP)
and surface wave studies, 427–28
Reattachment flow
in turbulent boundary layers, 220–26
Receptivity
boundary-layer, 235
to long-wave free-stream disturbances, 137–64
Reflection techniques
and electrophoretic motion of a spherical particle, 84–85
Renal circulation, 198
Reynolds-averaging procedure
in shear flows, 289
Reynolds lubrication theory, 181, 183
Reynolds-mean flow, 301
Reynolds number(s)
and coherent structures, 296
crossflow
in swept-wing flows, 241–42, 245–46
and dense-gas dispersion, 336, 338
and fast-chemistry reaction rate, 108
in flames, 103, 123, 127–28
in free shear flows, 288, 302–3, 309
high
and blood flow, 172–80
and differential diffusion effects, 104
and scalar dissipation rate, 107
low
blood flow at, 180–90
in microcirculation, 191
for rotating cone flow, 265, 269
and rotating disk flow, 258–59
and steady flows, 31
in swept-wing flows, 247, 257, 272–74
in three-dimensional boundary-layer flow, 271
transition
in three-dimensional boundary-layer flows, 243
in turbulent boundary-layer separation, 209–10, 221, 223, 226
and turbulent diffusion flames, 110, 114, 117, 124
and turbulent mixing, 123, 126
Reynolds shearing stress
in turbulent boundary layers, 212, 214, 217–19, 221–23, 227–28
Reynolds stress(es)
conversion mechanism, 291
in a plane shear flow, 289
and turbulent diffusion flames, 115–16
and wall flows, 7
Reynolds-stress mechanism
fine-grained-turbulence, 293
Rib flows
in turbulent boundary layers, 224–27
Richardson number
and numerical models of the ocean boundary layer, 429–30
and ocean turbulence, 436–37, 439, 443
Richardson-number correction
in gradient transport modeling, 113
Rotating cone
three-dimensional flow of, 264–70
Rotating disk
and three-dimensional boundary-layer flow, 258–64
Rotating sphere
three dimensional flow of, 267, 269
Rouleaux
in blood flow, 190

S

Salinity
of seawater, 430–31
SALLY computer code, 243–44
Salt fingering
in the North Atlantic, 445–47
in the ocean, 431–36
Satellite computer systems, 389–90
Satellites
contamination of, 390
Scalar dissipation
and fast-chemistry reaction rate, 107
and turbulent diffusion flames, 129
in turbulent flows, 102–3, 108–9, 118
and turbulent mixing, 121–23
Schmidt-number effects
in liquids, 103
and turbulent mixing, 123–27
Schubauer-Skramstad experiment
for Tollmien-Schlichting waves, 137–38
Seawater
density of, 430
temperature and salinity of, 430–31
Sedimentation
and phoretic motions, 96–97
and phoretic transport, 76
Separation
in turbulent boundary layers, 205–32
Shear flows
free turbulent
coherent structures in, 285–311
Shear-generated ocean turbulence, 436–44
Shear layer(s)
in turbulent boundary-layer separation, 212–13, 220–23, 225–26, 231
Shear-layer problems
computational and temporal, 306–8
Shear waves
in viscoelastic fluids, 24–25

Shearing stress
in turbulent boundary layers, 207, 209, 214, 217–19, 226
Shock
bow
and nonequilibrium aerodynamics, 37–39, 42
curved
and nonequilibrium aerodynamics, 57–58
Shock-density ratio
and nonequilibrium aerodynamics, 44, 52–54, 56, 58
Shock layer
and blunt-body flows, 52–54
and hypervelocity aerodynamics, 37–38
"Shock mapping,"
and nonequilibrium aerodynamics, 41–44
Shock standoff
delta-wing, 54
Shock tube
and nonequilibrium aerodynamics, 45–46, 48, 50
Shock tunnel
and nonequilibrium aerodynamics, 45–46, 49–50
nonreflected
and nonequilibrium aerodynamics, 49–50
reflected, 46–48, 50
Shock wave(s)
and hypervelocity aerodynamics, 37–38, 40
and rarefied gas dynamics, 396, 403–7
and transatmospheric flight, 390–91
in turbulent boundary layers, 230–31
and turbulent wall flows, 10
and viscoelastic fluids, 31
Shocks
in hyperbolic equations of viscoelastic fluids, 26–28
and nonequilibrium aerodynamics, 55–56
Shvab-Zeldovich coupling functions, 104
Slip velocity
in boundary-layer flows, 147–49
and fluid particles, 81–82
at solid/fluid interfaces, 61–62, 65–67, 69–71, 75, 77, 79, 83–84, 96
and stress discontinuity at an interface, 72–74
Smoluchowski's Equation, 76, 87
Sonar
and ocean boundary-layer studies, 425
Space
in computational fluid dynamics, 351–52
Space Shuttle, 57
STS-3 and STS-4, 388–89
Spanwise variations
and swept-wing flows, 248–50
Spectral-element methods
in computational fluid dynamics, 350, 362, 365–67
Spheres
with thin interfacial layers, 76–78
Spheroids
electrophoretic behavior of, 80
Stability
of three-dimensional boundary layers, 235–76
Stability experiments
in swept-wing flows, 250–54
Staircase structure(s)
and salt fingering, 436
in seawater temperature and salinity, 431–32, 435
thermohaline, 433, 435
Stall
on helicopter and compressor blades, 229
Step flows
in turbulent boundary layers
backward-facing, 220–24
forward facing, 224–27
Stokes equation(s)
in blood-flow problems, 190
and electroosmosis, 66–67
for a fluid particle, 81–82
and interfaces, 83
and phoretic transport of colloidal particles, 65
and phoretic transport of rigid particles, 75
and plasma flow, 180–83
Stokes-flow problem
and spheres with thin interfacial layers, 76–77
Stokes problem
and steady flows, 31–32
Stokes shear wave
and boundary-layer flows, 143–45, 152–53
Streamwise instabilities
in three-dimensional boundary-layer flows, 238
Streamwise instability
in swept-wing flows, 247
in a three-dimensional boundary layer, 237
Stress discontinuity
and fluid particles, 81–82
and slip velocity at an interface, 72–74
in solid/fluid interfaces, 66
Stresses
and fluids with complex microstructure, 21–22
STS orbiter(s), 389
flow fields, 397
Stuart's disturbance equations
in swept-wing flows, 242
Supercomputers
and computational fluid dynamics, 348–50, 354, 356, 369–73, 378–79, 382
Surface curvature
and turbulent boundary-layer separation, 216–19, 231
Surface-pressure fluctuations
in turbulent boundary-layer separation, 213–16, 231
Swept-wing flow(s), 236–58
attachment line in, 271–74
crossflow instability in, 269
interaction theory, 254–56
later stages of transition in, 270
Navier-Stokes equations, 256–57
and spanwise variations, 248–50
stability and transition prediction, 243–46
stability experiments, 250–54

T

T-S waves
see Tollmien-Schlichting wave(s)
Tank-treading motion
in blood flow, 188–90
Taylor-Görtler instability
in swept-wing flows, 247
Temperature
of seawater, 430–31
Thermocapillary transport, 93
Thermodynamic equilibrium
and nonequilibrium aerodynamics, 38
Thermodynamic parameters
and wall flows, 4–7, 9–11
Thermodynamic principles
and phoretic transport of particles, 94
Thermoosmosis
at a solid/liquid interface, 71–72
Thermophoresis, 78, 88
of colloidal particles, 91–92

Time
  computational fluid dynamics, 351–52
Tollmien-Schlichting wave(s)
  and boundary-layer flows, 137–38, 160, 162–64
  due to leading-edge boundary-layer growth, 143–50
  generation by changes in surface geometry, 150–59
  stability diagram for, 140–42
  and swept-wing flows, 248–49
  and three-dimensional flows, 236–38
Topography
  and dense-gas dispersion, 335–37, 341
Total Variation Diminishing (TVD) schemes
  in computational fluid dynamics, 362
Tourniquet
  and collapsible tube flow, 175
Transition experiments
  in swept-wing flows, 246–48
Transition prediction
  in three-dimensional boundary-layer flows, 243–46
Transition process
  in boundary-layer flows, 138
Transitory detachment (TD)
  in turbulent boundary layers, 206–7
Tubes
  collapsible
    flow in, 175–77
Turbulence
  and computational fluid dynamics, 348, 379
  and dense-gas dispersion, 321, 331
  fine-grained
    in a shear flow, 286–309 passim
  obstacle-generated
    and dense-gas dispersion, 333
  ocean, 419–48
  structure-generated
    and dense-gas dispersion, 334–35
Turbulence control
  parameters, 2–4
  in wall flows, 1–16
Turbulent boundary-layer separation, 205–32
  and surface curvature, 216–19, 231
  and surface-pressure fluctuations, 213–16, 231
Turbulent closure
  empirical K-theory for, 330
Turbulent diffusion flames, 101–31
  calculation methods, 109–10
  complex and finite rate chemistry, 110–11
  and density gradients, 102
  and fast chemistry, 101–2, 104–9, 116–17
  flame structure, 127–31
  and gradient transport models, 111–14
  heat release in, 114–17
  mixture fraction, 103–4
  and turbulent mixing, 119–27
  and turbulent transport, 111–19
Turbulent mixing
  and conserved scalar probability density functions, 119–21
  and scalar dissipation, 121–23
  and Schmidt-number effects, 123–27
  and turbulent diffusion flames, 119–27
Turbulent transport
  gradient modeling, 111–14
  nongradient models, 117–19
  and turbulent diffusion flames, 111–19

U

Urinary system
  fluid flow in, 168

V

Van der Waals forces, 68
Vascular geometry
  and hemodynamic effects, 191–94
Vascular networks
  blood flow in, 190–99
Vascular viscoelasticity, 194
Veins
  and collapsible-tube flow, 175–76
  free of atherogenesis, 178, 180
Velocity field
  in dense-gas dispersion, 321, 337
Velocity profiles
  in turbulent boundary layers, 207–12, 217–18, 226, 228–29
Viscoelastic flows
  mathematical analysis of, 21–33
Viscoelastic fluids
  mathematical analysis of
    classification of type, 23–25
    global existence and asymptotic decay, 27–28
    local existence of solution for initial-value problems, 23, 25–27
    propagation and development of singularities, 28–31
  Rayleigh problem in, 28–29
  steady flows of, 31–33
Viscosity
  in blood flow, 187–90
  and shear-layer spreading, 291
Viscosity coefficients
  and mean free path of a molecule, 403
Viscous dissipation
  of mean-flow kinetic energy, 290–91
  in shear flow, 297, 303, 309
Vlasov equation
  cellular-automata model to solve, 357
Von Kármán vortex street
  and boundary-layer flows, 148–49
Vortex structure
  crossflow
    in swept-wing flows, 250–54
Vortices
  and rotating disk flow, 258–60, 262–64
  Taylor, 287–88
  in turbulent boundary-layer separation, 222, 224–26
Vorticity
  in dense-gas dispersion, 328–29
  streamwise
    in rotating cone and sphere flow, 264–70
    and three-dimensional flows, 236–37, 275

W

Wake
  in turbulent boundary layers, 207, 209
Wall
  law of the, 207, 209–10
Wall flows
  geometric parameters, 7–9, 11–13
  thermodynamic parameters, 4–7, 9–11
  turbulence control in, 1–16

turbulence production, 3
Wall suction/injection
and wall flows, 5
Wall turbulence
altering, 3–4
control of, 15–16
sensitivity of, 13–16
steady-state controls, 4–13
spatially varying inputs, 9–13
uniform inputs, 4–9
Wave(s)
acceleration
in viscoelastic fluids, 30–31
in attachment-line instability flow, 274–75
internal inertio-gravity, 436–37
oceanic internal, 438–39
in rotating disk flow, 260–64
in swept-wing flows, 245, 254–56
see also Tollmien-Schlichting wave(s)
Wave breaking
surface
and ocean boundary layer, 423, 425–27
Wave envelope
in shear flows, 287–89, 293–94, 296–97, 299–300, 302–3, 306, 308
Wave field
ocean internal, 437, 439–41
Wave number
spanwise
in a shear layer, 300–1, 305–6
Wave propagation
arterial, 173–75
in blood-flow studies, 178
Wave spectrum
Garrett & Munk (GM) internal, 437, 440–41
Wedge flows, 55–56
Wind forcing
and turbulence in the ocean boundary layer, 430
Wind-speed conditions
and dense-gas dispersion, 336–37
Wind stress
and ocean boundary surface layer, 423–24
and ocean surface layer, 420, 422, 424
Wind tunnels
for physical modeling of dense-gas dispersion, 337, 340
Windkessel theory
of arterial wave propagation, 173
Womersley number
and arterial wave propagation, 174
in microcirculation, 191

XYZ

X-ray-induced excitation
and gas flow study, 401
Yaw
in swept-wing flows, 246
Young-Laplace equation
for nonspherical droplets, 81
Zarf
and rotating disk flow, 259–60
Zeta potential
of colloid particles, 87